Electrodeposition of cobalt–tungsten alloys from alkaline citrate containing bath as alternative for chromium hexavalent replacement

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Copper is used in electronic applications such as interconnections in microelectronic systems. However, oxidation and diffusion of copper into gold and dielectric layers such as SiO2 influences the functions of electronic devices. One solution to this problem is to use barrier layers such as cobalt alloys for example Co–W and CoWP. Alloying of cobalt with tungsten improves its thermal resistivity, hardness, strength, corrosion and wear resistance. Therefore, it can also be used in other applications such as gas turbines, valves, and cutting tools. Cobalt–tungsten alloys have been considered as potential materials for various applications. This work investigates the wear and corrosion resistance behaviour of cobalt–tungsten–phosphorus alloys electroplated from alkaline citrate containing baths. The wear rates of the cobalt–tungsten alloy electrodeposits were lower than those of the unalloyed cobalt electrodeposits. The wear rate was also lower than those of chromium plated from hexavalent chromium plating bath. It was also demonstrated that the addition of small quantities of phosphorus into Co–W alloys improved the corrosion resistance of the alloy. In fact, the addition of phosphorus further improved the corrosion of

the alloy exposed to immersion test in comparison to cobalt–tungsten. The cobalt–tungsten alloys without having any phosphorus component were subjected to further oxidation of tungsten component followed by dissolution in deionised water during the immersion tests.